Development of the Executive Dashboard for the Puget Sound Ecosystem

The PSP Indicators Action Team

Phil Levin	May 27	Create 1st draft
Phil Levin	May 28	Edited, and added notes to portfolios
Tim Quinn	May 29	Edited
Phil Levin	June 2	Edit to include X-partnership performance mgt comments
Tim Quinn	June 3	Added some alternative indicators
Phil Levin	June 3	Edited
Rob Duff	June 4	Edited
Phil Levin	June 4	Edited to accommodate Rob's comments

Introduction

The Indicator Action Team was charged with developing a performance dashboard that communicates strategic objectives and enables policy makers, managers, the public to measure, monitor and manage the key actions needed to achieve PSP goals. Here, we define a dashboard as a relatively small collection of interconnected ecosystem and human dimension indicators that reflects both short- and long-term progress in restoring the health of Puget Sound. An effective dashboard should:

- provide a snapshot of the overall health of the Sound
- provide an early warning of negative trends so that corrections can be made quickly
- show the impacts of new or ongoing management strategies
- reveal the health of key ecosystem and human dimension metrics in advance of State of the Sound reports
- transparently reveal how funding for management actions produces results
- resonate with the public and be socially marketable (not considered here)

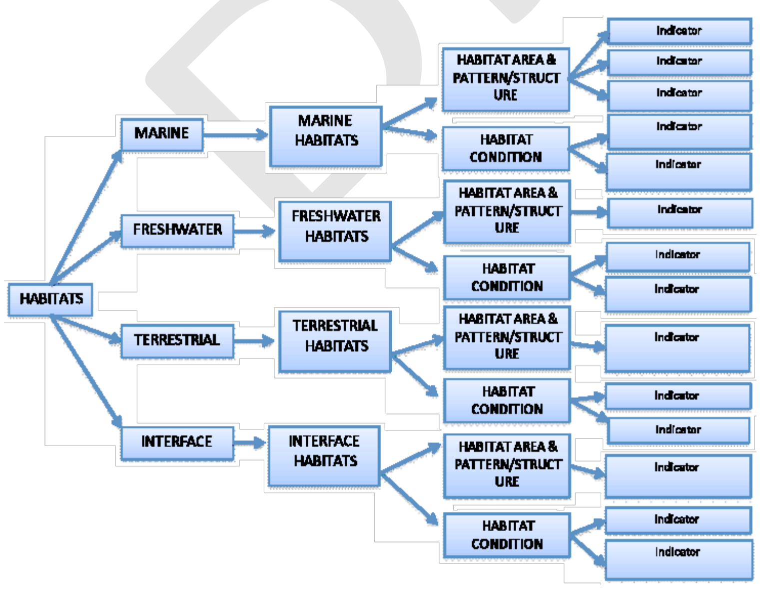
A performance dashboard must communicate progress towards two related, but different goals. The first goal is to monitor status and trends of the ecosystem. Status monitoring is fundamentally concerned with documenting spatial and temporal patterns in ecosystem components that represent our collective management actions. A second aim of monitoring is to evaluate the effectiveness of management strategies. Effectiveness monitoring thus aims to detect changes in ecosystem status that are caused by specific management actions, and allows a determination of how well predictions about appropriate management strategies performed, and provides a formal means for learning about the system and how management actions influence the system. This second goal often requires more targeted effectiveness monitoring that focuses on how measuring how a specific management strategy affects a part of the system while controlling for other confounding issues. The dashboard presented here focuses primarily on status monitoring.

Developing the performance dashboard for non-human components of the Puget Sound ecosystem: Standing on the shoulders of previous PSP indicator efforts.

The development of the dashboard for non-human components of the ecosystem is built upon the foundation of previous indicator work conducted the PSP. In particular, the dashboard uses approaches outlined in Chapter 1 of the Puget Sound Science Update (PSSU) to integrate work summarized in "Environmental Indicators for the Puget Sound Partnership: A Regional Effort to Select Provisional Indicators (Phase 1);" the PSP Action Agenda; and the 2009 PSP Technical Memoranda, "Identification of Ecosystem Components and Their Indicators and Targets," and "Ecosystem Status and Trends". Below we outline how the logic, principles, and rationale for the dashboard development, focused on the status of non-human components of the Puget Sound ecosystem.

Adopt the philosophy of the Open Standards for the Practice of Conservation.

The Indicator action team employed a straightforward approach to organize indicators into logical and meaningful ways in order to assess progress towards policy goals. We used the PSSU Chapter 1 framework, which was derived directly from the implementation of the Open Standards for the Practice of Conservation in Puget Sound. Our framework thus begins with the six Goals of the PSP. We then decomposed those goals into unique ecological Focal Components within specific habitat domains (i.e., marine, freshwater, terrestrial, and interface/ecotone). Each focal component is characterized by Key Attributes, which describe fundamental aspects of each focal component. Finally, we map Indicators onto each ecosystem key attribute. We define **indicators** as bio-physical or socio-economic measurements that serve as proxies of the conditions of key attributes of natural and socio-economic systems, whereas **ecosystem attributes** are characteristics that define the structure, composition and function of the ecosystem that are of scientific and/or management importance, but insufficiently specific and/or logistically challenging to measure directly. Thus, indicators provide a practical means to judge changes in ecosystem attributes related to the achievement of management objectives. The



framework is illustrated to the left for the Habitat goal.

Use of this framework ensured that we were cognizant of how dashboard measures related to PSP goals, focal components and key attributes.

Consider a broad range of diverse indicators

We began populating the framework described above with indicators by first gathering all indicators that have been previously selected for use by the PSP. Chapter 1 of the PSSU compiled a compressive list of such indicators including:

- About 250 indicators from "Environmental Indicators for the Puget Sound Partnership: A Regional Effort to Select Provisional Indicators (Phase 1)" that were considered "good," "potential," or "possible future."
- 102 environmental indicators that were listed in the PSP Action Agenda based on a review by the PSP Science Panel.
- 160 indicators from the process specifically guided by the Open Standards for the Practice of Conservation
- 43 indicators from the PSP Technical Memorandum, "Ecosystem Status and Trends," (a subset of these were used in the 2009 State of the Sound report). .
- >150 water quantity indicators derived from a literature review of indicators that may track various aspects of the hydrologic flow regime

The entire set of indicators was combined and redundant indicators removed, and then organized according to goals, ecosystem components and attributes of our framework.

Objectively evaluate indicators

The Indicators Action Team began by using the indicator evaluation scheme discussed in Chapter 1 of the PSSU. In the PSSU, indicator criteria were divided into three categories: primary considerations, data considerations, and other considerations. Primary considerations are essential criteria that should be fulfilled by an indicator in order for it to provide scientifically useful information about the status of the ecosystem in relation to PSP goals. Data considerations relate to the actual measurement of the indicator. Other considerations criteria may be important but not essential for indicator performance.

The evaluation criteria are as follows:

Primary considerations

1. **Theoretically-sound**: Scientific, peer-reviewed findings should demonstrate that indicators can act as reliable surrogates for ecosystem attribute(s)
2. **Relevant to management concerns**: Indicators should provide information related to specific management goals and strategies.

3. **Responds predictably and is sufficiently sensitive to changes in a specific ecosystem attribute(s)**: Indicators should respond unambiguously to variation in the ecosystem attribute(s) they are intended to measure, in a theoretically- or empirically-expected direction.
4. **Responds predictably and is sufficiently sensitive to changes in a specific management action(s) or pressure(s)**: Management actions or other human-induced pressures should cause detectable changes in the indicators, in a theoretically- or empirically-expected direction, and it should be possible to distinguish the effects of other factors on the response.
5. **Linkable to scientifically-defined reference points and progress targets**: It should be possible to link indicator values to quantitative or qualitative reference points and target reference points, which imply positive progress toward ecosystem goals.
6. **Complements existing indicators**: This criterion is applicable in the selection of a suite of indicators, performed after the evaluation of individual indicators in a post-hoc analysis. Sets of indicators should be selected to avoid redundancy and increase the complementary of the information provided, and to ensure coverage of Key Attributes.

Data considerations

1. **Concrete**: Indicators should be directly measureable.
2. **Historical data or information available**: Indicators should be supported by existing data to facilitate current status evaluation (relative to historic levels) and interpretation of future trends.
3. **Operationally simple**: The methods for sampling, measuring, processing, and analyzing the indicator data should be technically feasible.
4. **Numerical**: Quantitative measurements are preferred over qualitative, categorical measurements, which in turn are preferred over expert opinions and professional judgments.
5. **Broad spatial coverage**: Ideally, data for each indicator should be available in all PSP Action Areas.
6. **Continuous time series**: Indicators should have been sampled on multiple occasions, preferably without substantial time-gaps between sampling.
7. **Spatial and temporal variation understood**: Diel, seasonal, annual, and decadal variability in the indicators should ideally be understood, as should spatial heterogeneity/patchiness in indicator values.
8. **High signal-to-noise ratio**: It should be possible to estimate measurement and process uncertainty associated with each indicator, and to ensure that variability in indicator values does not prevent detection of significant changes.

Other considerations

1. **Understood by the public and policymakers**: Indicators should be simple to interpret, easy to communicate, and public understanding should be consistent with technical definitions.
2. **History of reporting**: Indicators already perceived by the public and policymakers as reliable and meaningful should be preferred over novel indicators.
3. **Cost-effective**: Sampling, measuring, processing, and analyzing the indicator data should make effective use of limited financial resources.

4. **Anticipatory or leading indicator**: A subset of indicators should signal changes in ecosystem attributes before they occur, and ideally with sufficient lead-time to allow for a management response.
5. **Regionally/nationally/internationally compatible**: Indicators should be comparable to those used in other geographic locations, in order to contextualize ecosystem status and changes in status.

PSSU authors assessed each indicator against each evaluation criterion by reviewing peer-reviewed publications and reports. They chose the benchmark of peer-reviewed literature because it was consistent with the criterion of peer-review used the Puget Sound Science Update, and it was a criterion that was relatively easy to apply in a consistent fashion. However, the PSSU also included documentation of non-peer-reviewed support for indicators, and the Indicators Action Team, considered this as well.

Coarsely Rank Indicators

Chapter 1 of the PSSU provides the raw materials and suggests an approach for ranking indicators, but does not do so. The Indicator Action Team chose to apply the PSSU approach to the 100's of indicators suggested by different PSP indicator processes. Ranking requires careful consideration of the relative importance of evaluation criteria (since, of course failure to weight criteria is a decision to weight all criteria equally)

The Indicator Action Team used a weighting scheme for the indicator criteria that ranged from 0 to 1.0 that they felt reflected the aim of the dashboard. The weighting scheme is as follows:

Criteria	Weight
Theoretically-sound	0.5
Relevant to management concerns	1
Responds predictably & is sufficiently sensitive to changes in a specific ecosystem attribute(s)	0.5
Responds predictably & is sufficiently sensitive to changes in a specific management action(s) or pressure(s)	0.5
Linkable to scientifically-defined reference points & progress targets	0.75
Concrete	0.75
Historical data or information available	1
Operationally simple	1
Numerical	1
Broad spatial coverage	0.5
Continuous time series	1
Spatial & temporal variation understood	0
High signal-to-noise ratio	0
Understood by the public & policymakers	1
History of reporting	0.5
Cost-effective	0.5

Anticipatory or leading indicator	0
Regionally/nationally/internationally compatible	0.25

Time constraints prevented a full exploration of alternative weighting schemes. However, the goal of the ranking was not to finely separate individual indicators; rather, the aim was to generate a list of "top tier" indicators. Examination of two very different weighting schemes revealed that the "top tier" indicators do not differ among weighting schemes (although the rank order of indicators does shift).

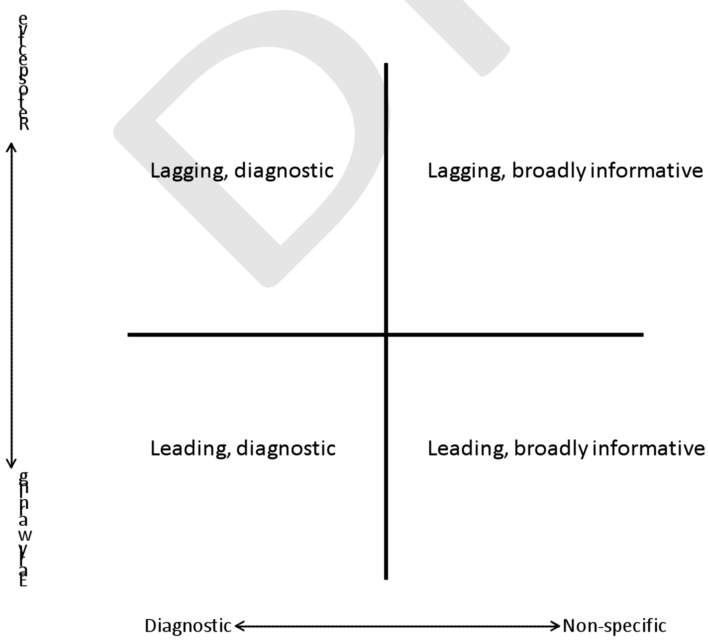
The team then scored each indicator as 1.0 when there was peer-reviewed evidence that that it met a criterion. When there was non-peer reviewed or ambiguous evidence that an indicator meets a criterion we gave it a score of 0.5. When it did not meet a criterion, it received a score of 0. This score was then multiplied by the criterion weighting, to produce a weighted score for each criterion. Weighting scores were then summed for all criteria to produce an overall ranking score.

In some instances Indicator Action Team members brought forward new indicators that had not yet been evaluated by the PSSU. These were treated as if they were "top tier."

Consider the specificity and sensitivity of indicators

The Action Team thought that a useful way to evaluate indicators was to consider in more detail the evaluation criterion "the indicator responds predictably and is sufficiently sensitive to a specific ecosystem attribute." Two of the terms in this criterion, "specific" and "sensitive," can be used to organize indicators according to the type of information they provide about attributes. An indicator's specificity depends on whether it reliably tracks few or many attributes. An indicator that provides information about many attributes is non-specific but broadly informative, while that serves well as a proxy for fewer attributes can be thought of as diagnostic of changes in specific ecosystem. Another informative axis on which to interpret an indicator is in terms of its sensitivity. An indicator that provides information about impending changes in attributes before they occur is an early warning or "leading" indicator. In contrast, an indicator that reflects changes in attributes only after they have occurred is a retrospective or "lagging" indicator.

The Indicator Action Team thus considered how highly-ranked indicators mapped along the axes of specificity and sensitivity by roughly plotting them on a graph such as the one shown to the left. The objective of this exercise was simply to be cognizant of what type of information each indicator would provide, and to



avoid selecting indicators from a single quadrant. No value judgment was made about individual quadrants (i.e., a leading diagnostic indicator was not considered any better than lagging, broadly informative indicator).

Consider portfolios of indicators

In assembling the non-human measures for the dashboard, the team explicitly viewed this as the creation of a portfolio of complementary indicators. The objective was not to represent every attribute, every process or every species, but rather was to assemble a scientifically credible portfolio of indicators that would provide a breadth of information about different ecosystem components over different temporal and spatial scales.

Three potential portfolios of Puget Sound vital signs

Using all available information the Indicators Team developed three alternative dashboard indicator portfolios. Each portfolio is scientifically robust and meaningful, and taken us a whole can be considered to be the "vital signs" of the Sound in a similar way that blood pressure, heart rate, or temperature may be vital signs of human health. The team first assembled Portfolio A, and this represents the Team's consensus as the best one to be included in the dashboard. Portfolios B and C are equally scientifically credible, but emphasize slightly different parts of the ecosystem.

There is nothing magical about these three portfolios--they achieve the critical aim of balancing coverage of indicators across PSP goals and degrees of sensitivity and selectivity. What we have provided is akin to a prix fixe menu. However, if PSP leadership desires, it is certainly possible to use a more ala carte approach. To this end, we have provided alternatives for some indicators in Portfolio A. As long as one of these alternatives is selected, the Portfolio will remain scientifically robust (albeit different in its emphasis). Also, there may be other criteria not considered here that are important to choosing one indicator over its alternative. For example, upon careful examination of logistical issues associated with sampling, we may find that it is twice as expensive to collect data on one indicator versus its alternatives. It may be wise to retain some flexibility in choosing specific indicators for the same attribute until a feasibility assessment (sampling plan) can be completed.

No explicit effort was made to rank indicators or portfolios by their social resonance or marketing potential. The Indicator Action Team felt that this was a judgment best left to other parts of the PSP. Indeed, the Team strongly urges a careful and rigorous examination of the social value of these portfolios. We emphasize that these portfolios are built on the foundation of all the PSP indicator efforts (as well as the work by PSP precursors).

Table 1. A tabular representation of each of the three Portfolios of Natural Dimension Dashboard Indicators. Portfolio A is the suite of indicators recommended by the Indicator Action Team; however, Portfolios B and C are equally scientifically credible.

Portfolio A.

Indicator	PSP Goal	Sensitivity	Specificity	Comments	Scientifically Suitable Alternatives
Number of Southern Resident Killer Whales	**Species** and food webs	Low	Moderately non-specific	Poor indicator of ecosystem health, but provides information on the status of an important ESA-listed species	Harbor Seals, rockfish
Number of wild Chinook Salmon	**Species** and food webs	Moderately high	Moderately non-specific	A good non-specific indicator of the status of freshwater / nearshore ecosystems and the status of an important ESA-listed species	Crab numbers
Number of Jellyfish	Species and **food webs**	High	Moderate	An excellent indicator of ecosystem structure and function, especially of energy transfer and pelagic community composition. Jellyfish abundance can be linked to fishing impacts, eutrophication, habitat modification (shoreline armoring), shipping traffic, and other human activities.	Herring can substitute for jellyfish in this portfolio, but serve as a proxy for fewer ecosystem processes. Chlorophyll A is an excellent indicator of energy and material flow through food webs. In this portfolio, it is included in the water quality index. If that index is removed, then Chl A, could be an alternative to Jellyfish (or herring)
Numbers key Terrestrial Bird species	**Species** and food webs	Moderately Low	Diagnostic	Phenological timing of migrations serves as a useful leading indicator of climate change impacts. Bird Community composition change indicates broad-scale (structure/function) land- use effects, Changes in cavity nesters indicate changes to specific habitat elements and cascading effects on cavity dependent species Marbled murrelets are sensitive to losses of a specific seral stage (old forest) and forest fragmentation.	Numbers of Murrelets, Murrelets subject to marine (food limitation and fishing mortality) and terrestrial disturbance (loss and fragmentation of old forests). Stillwater breeding amphibian, Indicator of land –use and fresh water quality/quantity. Phenological timing of breeding serves as a useful leading indicator of climate change impacts. Amphibian Community composition change indicates broad-scale (structure/function) land- use effects
Cover of eelgrass	Habitat	Moderate	Moderate	Eelgrass is a critical nearshore habitat. Several years of data are available. There remains much research to conduct to	Harmful algal blooms. Although very different from eelgrass in what they represent, HABs are an important

				determine causes of decline and increases.	component of water column habitat.
Percent of shoreline armored	Habitat	Moderate	Diagnostic	There is general consensus that shoreline armoring is not good for the ecosystem, but debate remains about whether there are thresholds and what those values would be. Further the location of the armoring within a drift cell has a strong determinant on its affect. i.e., a small amount of armoring in the wrong place can have a bigger effect than a large amount placed elsewhere. It can be easily measured, and It is clear that cumulative effects of armoring is of major importance, especially within the context of other shoreline stressors.	Marine riparian condition. Like fresh water riparian, marine riparian structure (tall shade trees, organic matter and CWD input, water filtration) can influence shoreline functions (e.g., habitat for forage fish)
Land use / land cover	Habitat	Moderate	Diagnostic	Changes in extent and quality of ecological systems can represent threats to obligate species associated with those systems. Tracking land use and cover is consistent with coarse filter approaches to conservation. Also provide estimates of working land conversion rate, impervious surface changes, and changes to habitat, which are part of delisting criteria for salmon and other species	Human footprint analysis, which calculates an index of human effects on elements of biodiversity from coarse scale land-use/cover. More informative than simple changes to land cover and has growing empirical evidence support (e.g., Leu et al 2008)
Ecology Freshwater and Marine Water Quality Indices	Water quality	Moderate	Non-specific	The freshwater index is an index of key freshwater quality metrics compared to standards or expected conditions. Metrics include bacteria, pH, temperature, dissolved oxygen, nutrients and sediment. Provides a score 0-100. The contribution of individual metrics can be assessed as with all indices. The marine index is an index of key marine	

				water quality metrics compared to expected conditions. Uses a modular approach to generate a eutrophication index which is combined with natural conditions yielding the overall composite index. Provides a score 0-100 while also displaying status and trends for each component.	
Ecology Sediment Quality Triad Index	Water quality	Moderate	Moderately diagnostic	An index of three sediment components: chemistry, toxicity and sediment-dwelling organisms. Data is collected on both a basin-wide and urban bay scale.	The sediment chemistry component is often looked at individually. This component of the triad is being refined to better quantify comparisons to Sediment Management Standards.
Toxics in fish	Water quality	Moderate	Moderately diagnostic	Measure of persistent bioaccumulative contaminants. Relevant to human health and food web toxic loadings.	Toxics in Mussels
Violations of DOE instream flows	Water quantity	Low	Non-specific		
Percent of monitored stream flows below critical levels	Water quantity	Moderately high	Moderate	A seasonally-dependant measure of critical stream flow based on historical comparisons. Imperfect measure of water availability. While stream flows are impacted by groundwater, a more direct measure of groundwater availability is needed.	% time in-stream flows met August – September. A variation of the same measure based on regulatory levels set for minimum flows as opposed to historical comparisons.

Portfolio B.

Indicator	PSP Goal	Sensitivity	Specificity	Comments
Number of Harbor Seals	Species and food webs	Low	Moderately non-specific	Important predators in the system, and good indicator of fish community composition, and population condition. Historical data are present, with diet data available back to the early 1900's.
Number of wild Chinook Salmon	Species and food webs	Moderately high	Moderately non-specific	
Number of herring	Species and food webs	High	Moderate	*Responsive to* environmental conditions, making them a good indicator of ecosystem, but it is difficult to separate natural vs. human causes of their population fluctuations. They are an important diet item to a number of species of interest. They provide some of the same information as jellyfish, but jellyfish also are diagnostic of some human perturbations.
Numbers of Murrelets	Species and food webs	Moderately Low	Diagnostic	Phenological timing of nesting serves as a useful leading indicator of climate change impacts. Marbled murrelets are sensitive to losses of a specific seral stage (old forest) and forest fragmentation.
Cover of eelgrass	Habitat	Moderate	Moderate	
Percent of shoreline armored	Habitat	Moderate	Diagnostic	Measures "no net loss of ecological functions" goal as part of growth Management, and Shoreline Master Plans. Provides estimate of ecosystem process impairment –tied to many eco goods and services
Land use / land cover	Habitat	Moderate	Diagnostic	Changes in extent and quality of ecological systems; represents threats to obligate species associated with those systems. Tracking land use and cover is consistent with coarse filter approaches to conservation. Also provide estimates of working land conversion rate, impervious surface changes, and changes to

				habitat, which are part of delisting criteria for salmon and other species
Ecology Freshwater Water Quality Index	Water quality	Moderate	Non-specific	An index of key freshwater quality metrics compared to standards or expected conditions. Metrics include bacteria, pH, temperature, dissolved oxygen, nutrients and sediment. Provides a score 0-100. The contribution of individual metrics can be assessed as with all indices.
Ecology Marine Water Quality Composite Index	Water quality	Moderate	Non-specific	An index of key marine water quality metrics compared to expected conditions. Uses a modular approach to generate a eutrophication index which is combined with natural conditions yielding the overall composite index. Provides a score 0-100 while also displaying status and trends for each component.
Ecology Sediment Quality Triad Index	Water quality	Moderate	Moderately diagnostic	An index of three sediment components: chemistry, toxicity and sediment-dwelling organisms. Data is collected on both a basin-wide and urban bay scale.
Toxics in fish	Water quality	Moderate	Moderately diagnostic	Measure of persistent bioaccumulative contaminants. Relevant to human health and food web toxic loadings.
Freshwater Macro-invertebrate Index	Water quality	Moderately Low	Non-specific	
Percent of monitored stream flows below critical levels	Water quantity	Moderately high	Moderate	A seasonally-dependant measure of critical stream flow based on historical comparisons. Imperfect measure of water availability. While stream flows are impacted by groundwater, a more direct measure of groundwater availability is needed.

Portfolio C.

Indicator	PSP Goal	Sensitivity	Specificity	Comments
Number of Rockfish	Species and food webs	Low	Moderately non-specific	Analyses testing indicator performance include rockfish as the best indicator for some ecosystem attributes. Like killer whale, there is long response lag because of life history: delayed maturity, slow growth, and long life span. Historical data are available, although not always differentiated by species. 3 rockfishes were recently listed under ESA.
Number of dead sea- and shore birds from beach surveys	Species and food webs	Moderately high	Moderately non-specific	
Number of Jellyfish	Species and food webs	High	Moderate	
Numbers of crabs	Species and food webs	Moderately Low	Diagnostic	
Marine riparian condition	Habitat	Moderate	Moderate	Measures "no net loss of ecological functions" goal as part of Growth Management, and Shoreline Master Plans. Provides estimate of ecosystem process impairment –tied to many eco goods and services
Harmful algal blooms	Habitat	Moderate	Diagnostic	
Land use / land cover	Habitat	Moderate	Diagnostic	Changes in extent and quality of ecological systems; represents threats to obligate species associated with those systems. Tracking land use and cover is consistent with coarse filter approaches to conservation. Also provide estimates of working land conversion rate, impervious surface changes, and changes to habitat, which are part of delisting criteria for salmon and other species
Ecology Freshwater Water	Water quality	Moderate	Non-specific	An index of key freshwater quality metrics compared

Quality Index				to standards or expected conditions. Metrics include bacteria, pH, temperature, dissolved oxygen, nutrients and sediment. Provides a score 0-100. The contribution of individual metrics can be assessed as with all indices.
Ecology Marine Water Quality Composite Index	Water quality	Moderate	Non-specific	An index of key marine water quality metrics compared to expected conditions. Uses a modular approach to generate a eutrophication index which is combined with natural conditions yielding the overall composite index. Provides a score 0-100 while also displaying status and trends for each component.
Ecology Sediment Quality Triad Index	Water quality	Moderate	Moderately diagnostic	An index of three sediment components: chemistry, toxicity and sediment-dwelling organisms. Data is collected on both a basin-wide and urban bay scale.
Toxics in mussels	Water quality	Moderate	Moderately diagnostic	Long-standing, rich data set for measuring trends of toxic contaminants in the marine environment.
Freshwater Macro-invertebrate Index	Water quality	Moderately Low	Non-specific	
Percent of monitored stream flows below critical levels	Water quantity	Moderately high	Moderate	A seasonally-dependant measure of critical stream flow based on historical comparisons. Imperfect measure of water availability. While stream flows are impacted by groundwater, a more direct measure eof groundwater availability is needed.

Leu, M., S.E. Hanser and S. T. Knick. 2008 The Human footprint in the west: a large scale analysis of antorhopodign impacts. Ecological Applications 18: 1119-1139.

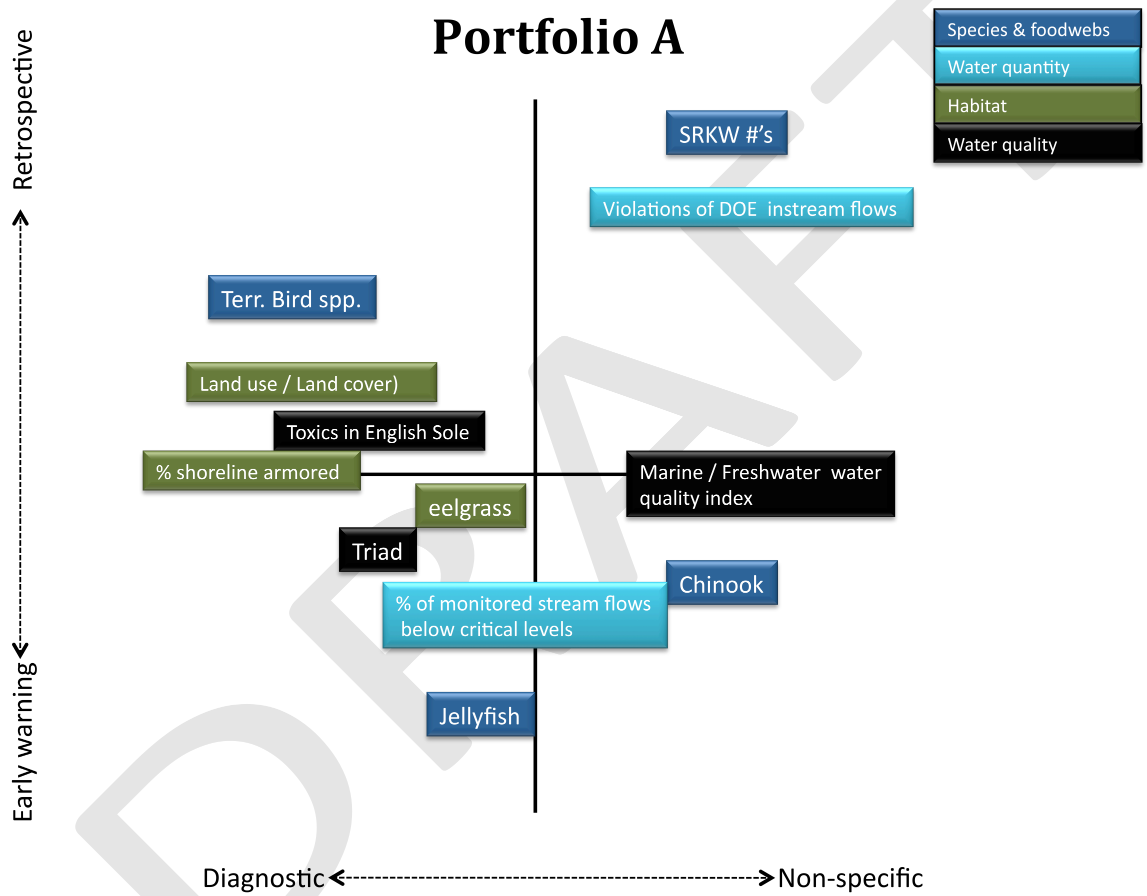


Figure 1. A graphical representation of portfolio A, showing roughly how indicators line up by PSP goal, specificity (X axis) and sensitivity (Y axis)

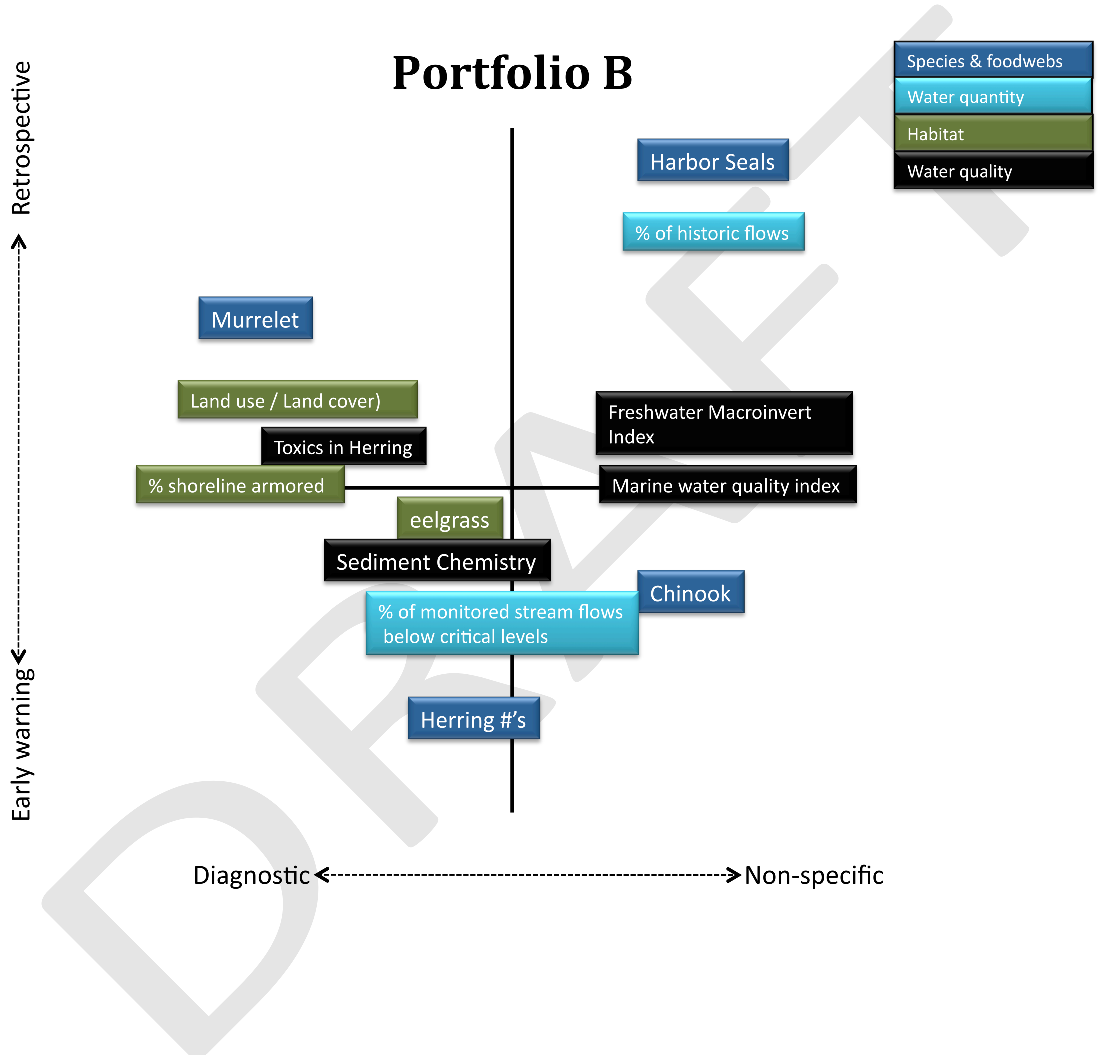


Figure 2. A graphical representation of portfolio B, showing roughly how indicators line up by PSP goal, specificity (X axis) and sensitivity (Y axis)

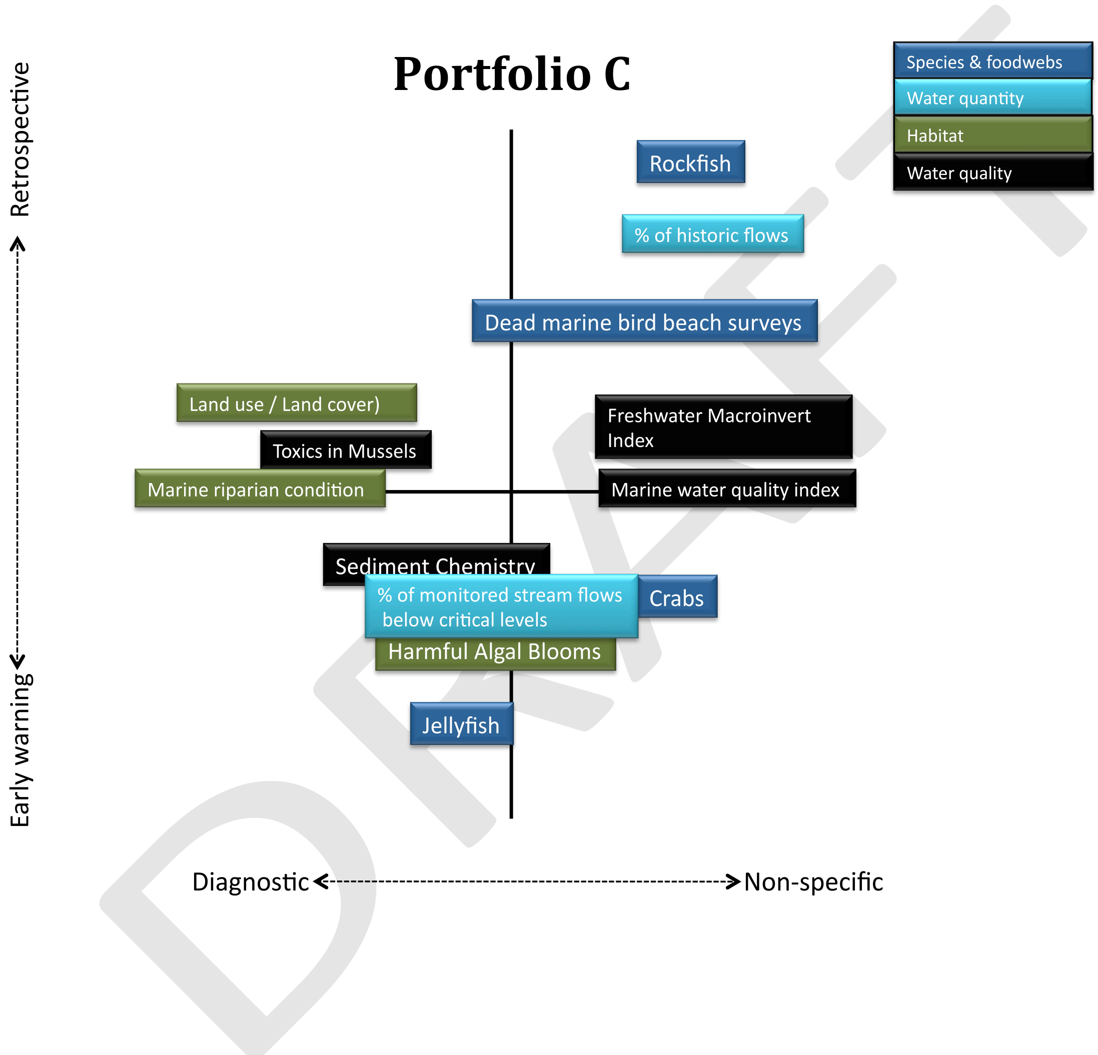


Figure 3. A graphical representation of portfolio C, showing roughly how indicators line up by PSP goal, specificity (X axis) and sensitivity (Y axis)

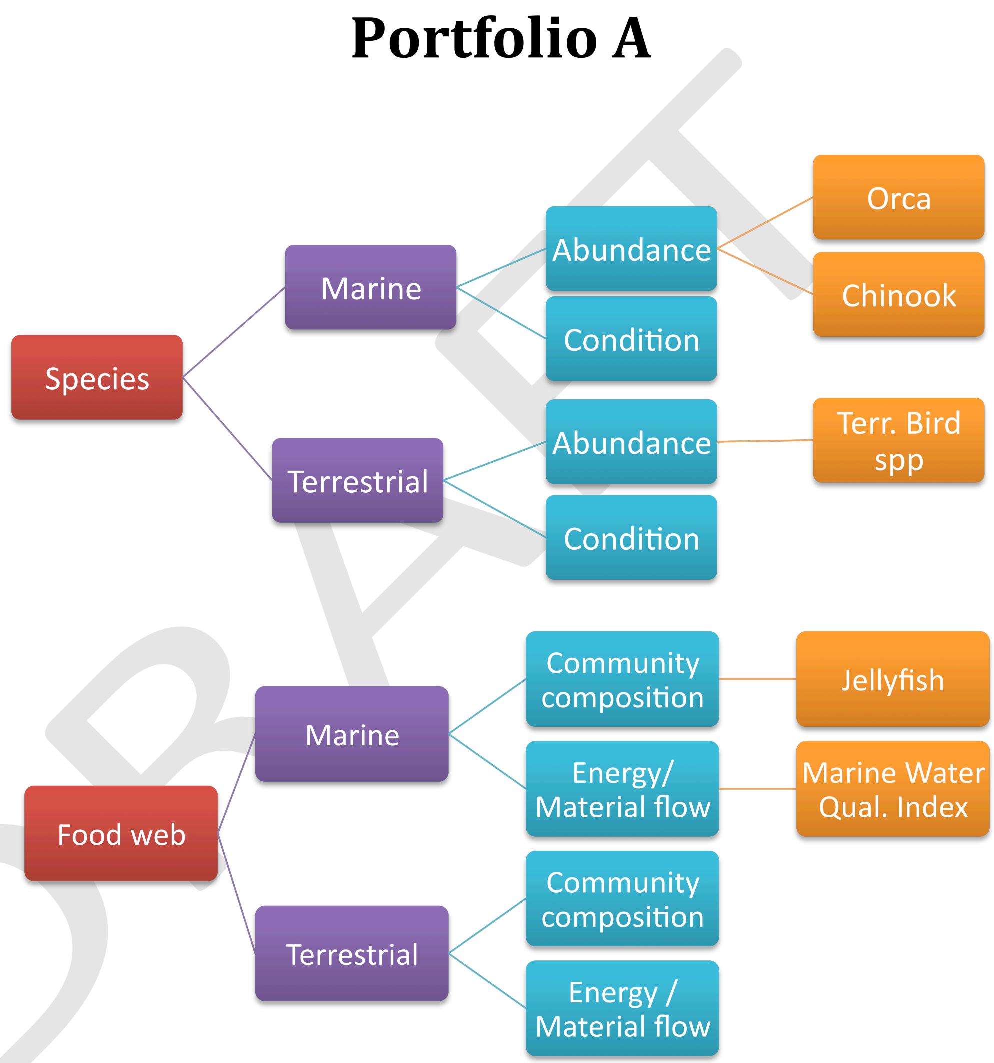


Figure 4a. A graphical representation of portfolio A, showing how indicators map onto PSP Goals, Ecosystem Components and Key Attributes

Portfolio A

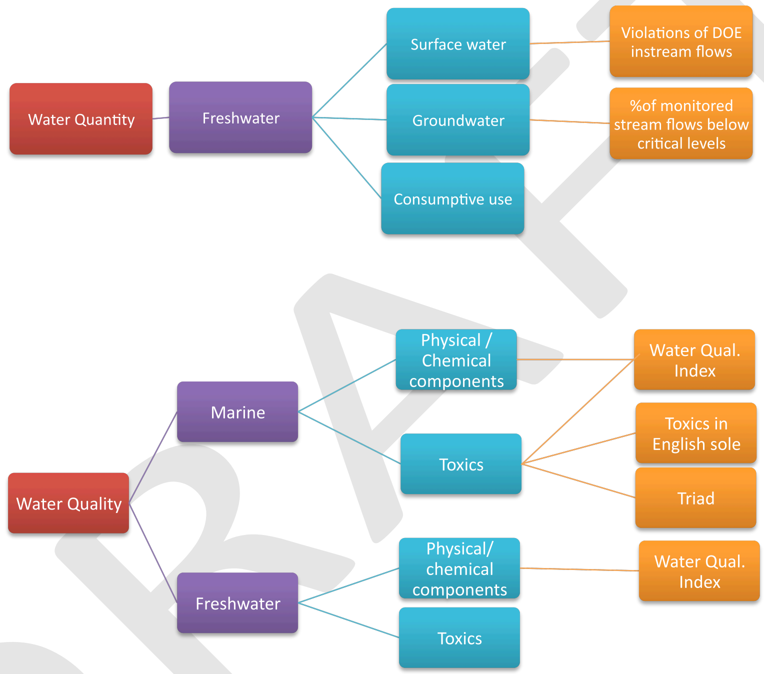


Figure 4b. A graphical representation of portfolio A, showing how indicators map onto PSP Goals, Ecosystem Components and Key Attributes

Portfolio A

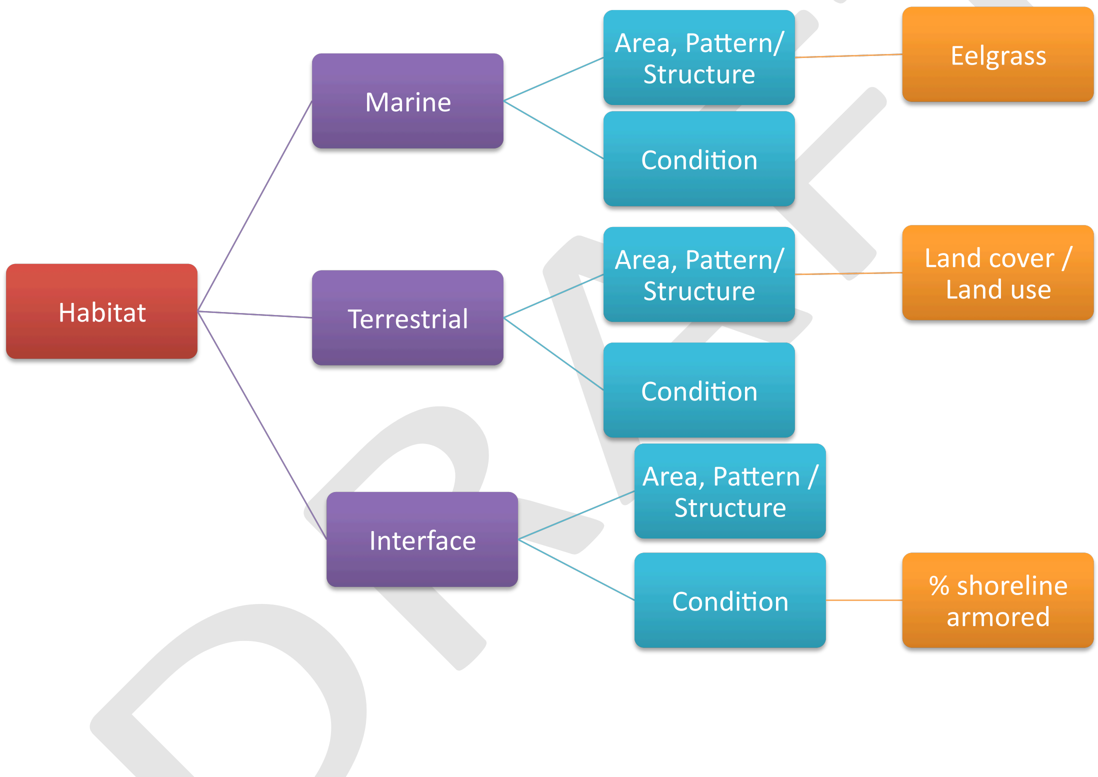


Figure 4c. A graphical representation of portfolio A, showing how indicators map onto PSP Goals, Ecosystem Components and Key Attributes